A DRAINAGE PROBLEM IN SOUTH COLUMBUS, WITH POSSIBLE SOLUTIONS

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by

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ABSTRACT

There is a small lake on the Roland Windmiller and adjacent properties in Columbus, Ohio. The lake is about five acres in area and has an average depth of about four feet. It is roughly elliptical in shape.

The drainage from the lake is toward the south-southeast for about 1200 feet, then cuts sharply to the southwest and into Whittler Ditch, and thence to the Scioto River.

The lake was formed when the water table rose above the land surface. This was due to the high permeability of the glacial outwash which underlies the area, and to the area's proximity to the groundwater discharge into the Scioto River.

The water is of fair quality, quite hard but not greatly polluted. The lake supports a diverse biologic community.

The area under study has a covering of glacial till and outwash with a thickness of about 140 feet. Underlying the glacial drift is 80 feet of Columbus Limestone, a massive fossiliferous limestone, Devonian in age, of great commercial value as aggregate.

The research area is in a low marshy area adjacent to the Scioto River, and the drainage is poor. A tile pipe was laid down around the turn of the century to facilitate drainage from the area. The lake appeared around 1940. An attempt to drain the lake took place in 1943, but a tragic accident resulted in which two members of the Windmiller family were killed. The situation was exacerbated

in the late 1960's when the tile pipe was damaged due to construction in the area, after which the lake enlarged to its present size.

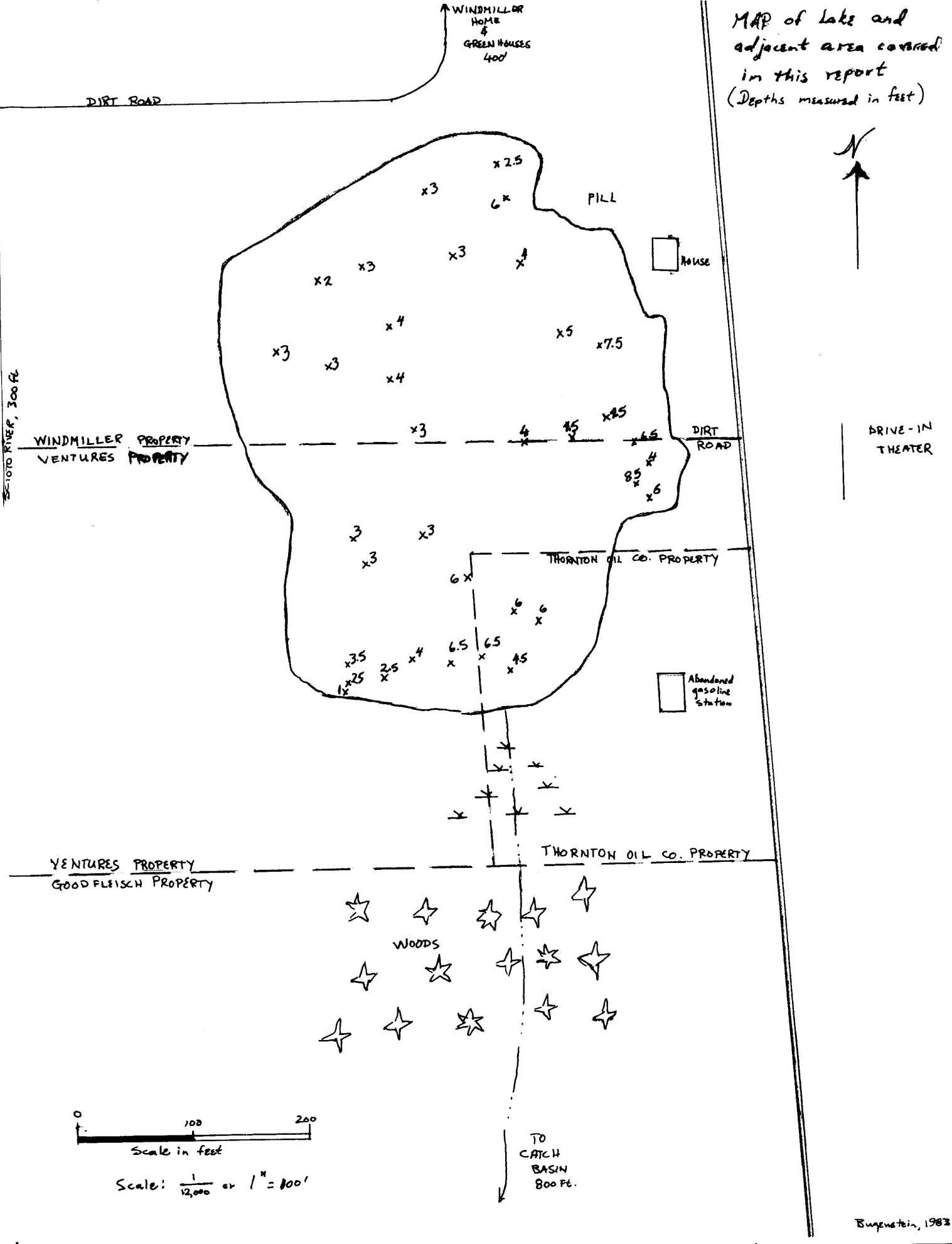
There are several possible solutions to this problem, but the most feasible seems to be laying down a plastic field pipe which will drain the lake and will connect with a similar pipe on the Vick property about 1200 feet to the south.

DESCRIPTION OF THE PROBLEM.

This paper deals with a drainage problem in the south side of Columbus, Ohio. The problem is a lake on and adjacent to the Roland Windmiller farm at 2997 South High Street. The lake covers valuable farmland, and is a breeding ground for mosquitos in the summer months. The lake is not scenic; it is full of tree stumps, and trash has been strewn along its shore. If the lake is drained the land can be used for agricultural purposes. There is also a valuable peat deposit on the Windmiller farm. If it is not drained, the lake may be a suitable site for a municipal or county park. The major emphasis of this investigation is to determine what caused the lake to form and to present possible solutions to the problem.

The natural drainage of the lake is to the south-southeast, from the Windmiller property, across the Venture property, and through the Goodfleisch and Vick properties. The Vick property is drained by use of a field pipe into Whittler Ditch and thence into the Scioto River.

The area has long been a swampy area with poor drainage. Long ago, a tile pipe was put through the area to facilitate drainage. In 1969, the Thornton Oil Company acquired the property in the


MAP of Lake and adjacent area covered in this report
(Depths measured in feet)
WINDMILLER HOME & GREEN HOUSES 400'
DIRT ROAD
PILL
House
WINDMILLER PROPERTY
VENTURES PROPERTY
DIRT ROAD
DRIVE-IN THEATER
SCIOTO RIVER, 300 ft.
THORNTON OIL CO. PROPERTY
Abandoned gasoline station
VENTURES PROPERTY
GOODFLEISCH PROPERTY
THORNTON OIL CO. PROPERTY
WOODS
TO CATCH BASIN 800 Ft.
0
100
200
Scale in feet
Scale: 1/12,000 or 1" = 1000'
Bugenstein, 1983

3100 block of South High Street. An excavation for fill for a filling station may have resulted in the breaking of the old tile pipe. The drainage was disrupted, which led to the expansion of the lake to its present size.

Now that the lake is here, how can the problem be solved? That is the question I hope to answer through this report.

A GENERAL OVERVIEW OF THE AREA

The lake is about 280 feet south of the Windmiller farmhouse. The land around the lake is marshy due to poor drainage. The land is used for farming and raising livestock.

A walk around the lake will reveal many geomorphologic features. In the dry season there is about an eight-foot wide shore on the northwest side of the lake. Mud cracks are present after long periods of low precipitation. Cattails and grasses which are in the water in April are generally high and dry in September. Along the west side of the lake, there are signs of active erosion taking place when the water level is high. There is a "ridge" about a foot high which is caused by erosion, beyond which the water level has not risen for any period of time.

Along the south side of the lake, the pattern of erosion is the same. In the southeast corner, the relief disappears, and a drainage channel has been naturally excavated toward the south-southeast. The drainage velocity was estimated to be less than a knot. Fish can be found swimming in the drainage channel at some times during the day. Surface drainage had stopped by early June.

Proceeding around the lake, an abandoned gasoline station can be seen on a bluff above the southeast corner of the lake. Several paths lead from the gasoline station property to the lake--these apparently have been created by fishermen and others using the lake for recreation.

Continuing along the eastern shoreline, one notices a dirt road leading from High Street westward that has been flooded by the lake. Still farther north, extensive filling is taking place, which juts into the lake from the northeast. The fill is about 12 feet above the surface of the lake. At that point the shoreline switches direction abruptly westward to complete the loop. Along the northern shore, the lake abuts the marshy area which has been described.

The area is teeming with wildlife. Pheasants, ducks and many other species of birds use the lake for their habitat; on one occasion we saw Canada geese flying over the lake. There are fox, deer, raccoons, and groundhogs in the area, common mammals in rural environments. Fish abound in the lake, the most noticeable being red carp which attain a length of about eight inches. Snakes can be seen slithering along the pond's edge, and insects are common in the summertime. The lake is an ecosystem in itself, demonstrating that life will incorporate into almost any body of water.

Another facet of the research area that is worth mentioning is the Scioto River which is located about 500 feet west of the lake. The river cuts a wide east-convex bend adjacent to the Windmiller property. The river has carved a 20-foot cut bank on the east side, while the western side of the river is occupied by a characteristic flood plain. In September, the river is typically at a low stage,

Fig. 1. View of the lake, looking south from the north shore

Fig. 2. View of the lake looking east from its western shore.

Fig. 3. View of the lake from its southern shore, looking northward. Note fill at left.

Fig. 4. The dry drainage channel leading from the southeast corner of the lake. June 11,1983.

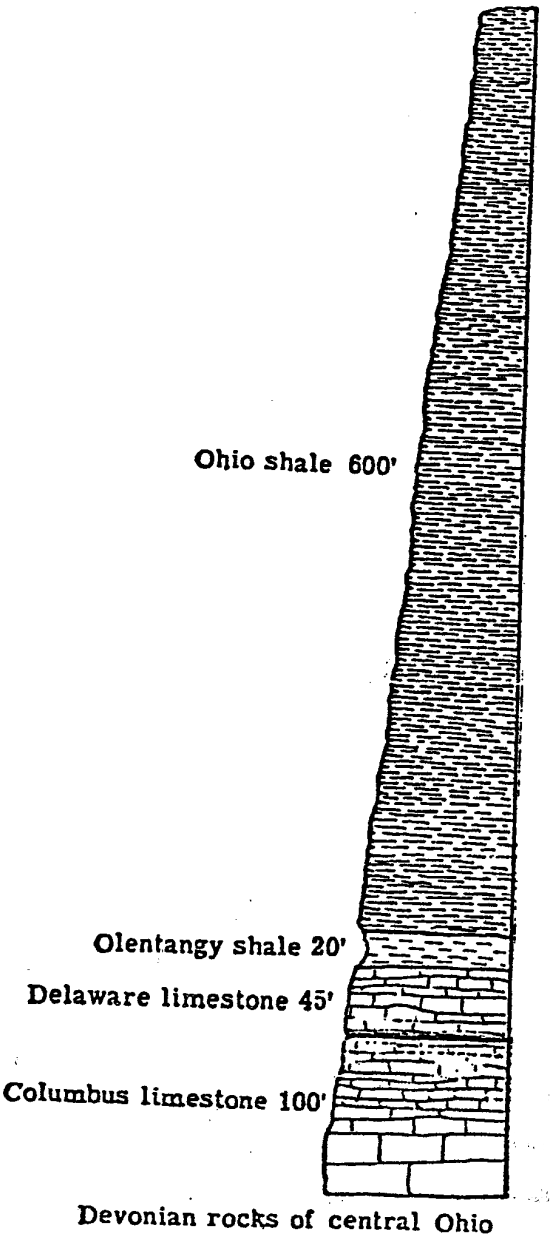
about two feet deep. In April the river is generally quite a bit higher, and is about five feet deep along the cut bank. In April the velocity of the river is much greater than that in September.

The bank material is composed of glacial outwash which is typical of the region. The river bank is well vegetated, which helps prevent erosion. An artificial levee was put along the eastern side of the river which is the western "wall" of the Ohio Canal, which ran parallel to the river. The canal channel remains visible, and it creates a buffer between the river and the eroding bank. The artificial levee seems to be doing a good job of protecting against further erosion of the cut bank.

GEOLOGY OF FRANKLIN COUNTY

The "exposed" rocks in Franklin County cover a time from the Silurian to the Mississippian Periods, about 70 million years. Generally, however, the bedrock in Franklin County is covered by glacial drift of varying thickness--thinner in the preglacial upland, thicker where glacial drift has buried former stream channels--so that exposed bedrock is fairly scarce. Most bedrock data has come from well logs.

The oldest surface bedrock in Franklin County is the Bass Islands Dolomite, deposited during the Silurian and attaining a maximum thickness of 373 feet. This rock may have been deposited as a limestone in an arid environment. The high concentration of magnesium ion in a near shore basin may have led to the dolomitization of the limestone.



Stratigraphic Section of Central Ohio.

From "Ohio Fossils"
OGS Bull 54

After the deposition of the Bass Islands Dolomite, there was a period of time when the rocks were subjected to erosion following a regression, or retreat of the sea. This erosion continued until middle Devonian time, a period of perhaps 25 million years.

In middle Devonian time, about 380 million years ago, the sea readvanced with respect to the land. This resulted in the creation of a carbonate shelf environment, a site of active limestone deposition. The Columbus Limestone was deposited in a fairly low-energy offshore environment. It is thick-bedded, reaching a maximum thickness of 105 feet, and contains abundant chert nodules which may have originated from volcanos or from radiolarian ooze. The limestone and chert are both abundantly fossiliferous.

Above the Columbus Limestone is the Delaware Limestone, with a maximum thickness of 45 feet. The Delaware Limestone was deposited in a quieter environment than the underlying rock--this indicates a continuing transgression by the sea. The Columbus Limestone and the Delaware Limestone outcrop predominantly in northwestern Franklin County.

In late Devonian time the sea level rose in Franklin County, resulting in the deposition of the Olentangy Shale and Ohio Shale in a quiet offshore environment. The Olentangy Shale is a green shale with a maximum thickness of twenty feet. The overlying Ohio Shale is a black shale with abundant pyrite, which resulted from the reducing, anoxic environment. The Ohio Shale has a maximum thickness of 600 feet, and can be correlated with other black shales in the Appalachian Mountain system. The Devonian Shales crop out in northern and eastern Franklin County.

The Mississippian system of rocks was deposited above the Ohio Shale. The earliest Mississippian formation is the Bedford Shale, attaining a total thickness of 85 feet. This shale was likewise deposited in a quiet offshore environment. Above the Bedford Shale, the Berea Sandstone was deposited in early Mississippian time. This sequence of sandstone over shale is significant in that it indicates a regression of the sea occurring during the time of deposition. The Berea Sandstone has been described by Schmidt and Goldthwait (1958) as a "relatively pure fine-grained sandstone." It has a maximum thickness of 35 feet. It and the other Mississippian formations crop out in northeastern Franklin County.

The Mississippian sea level rose, and the Sunbury Shale was deposited above the Berea Sandstone. This transgression was relatively short-lived, however. As the sea level dropped, the Cuyahoga Formation was deposited on top of the Sunbury Shale. The Cuyahoga Formation consists of sandstone and shale, and reaches a total thickness of 340 feet, although only the lower 165 feet outcrop in Franklin County. Through the entire section of the Cuyahoga Formation, a dramatic sea level decline can be traced. The Raccoon Shale is the lowermost member; it is a fine grained siltstone. Continuing upward, the Cuyahoga formation culminates in the Black Hand Sandstone Member, which was deposited in a prograding river delta environment. The Black Hand is a buff, fine-grained pure sandstone streaked with iron minerals. At some points it reaches a total thickness of 300 feet. It does not crop out in Franklin County.

Above the bedrock surface a layer of glacial drift was deposited as a result of successive advances and retreats of the Pleistocene Ice Sheet, beginning about 700,000 years ago, and ending about 10,000 years ago. Thickness of the glacial drift ranges from a few feet to many hundreds of feet where channel filling has taken place.

The geology of Franklin County reveals a sequence of Devonian transgression followed by a regression in Mississippian time. Until the Pleistocene glacial drift, there had been erosion or nondeposition since the Mississippian. Undoubtedly, a great thickness of bedrock has been eroded.

Generally, all the bedrock formations in Franklin County strike northerly and dip at low angles to the east. However, some deformation took place after the Permian Period.

The bedrock of the study area is Columbus Limestone, which is about 80 feet thick in this vicinity. The bedrock does not crop out in the research area, however, as it is covered by a layer of glacial drift about 140 feet thick.

A BRIEF HISTORY OF THE AREA

Prehistoric Indians were believed to have lived on the Scioto River cut bank, on what is now the Windmiller property. Extensive archaeologic work has unearthed bones, pottery, and other artifacts. An archaeological "dig" is presently being undertaken on the Scioto View School property just to the north of the Windmiller property.

In the early 1800's, the Ohio Canal was dug along the east side of the Scioto River. The canal was used to transport grain to the

newly developing Midwest. Along the canal, on the east-convex bend in the river, there was a checkpoint for canal boatmen and a lodging place for Indians and pioneers. It consisted of several buildings and was built after the Civil War. The canal was used until about 1890, then abandoned, but the lodging place was converted to a residence and was used until about 1965. The vacant house deteriorated and was repeatedly vandalized. All that's left today is ruins.

In 1917, Fred Windmiller bought property in south Columbus, and started a farm and greenhouse. A marshy area on the property had always been a nuisance, and around 1940 the lake began to develop. An attempt to drain this lake in 1943 ended in tragedy, however, when Fred Windmiller and his son, Fred Jr., were constructing a drainage trench from the lake to the Scioto River and the walls of the trench caved in. The two men were killed in the earth slide and the drainage project was abandoned.

In 1969 the situation was aggravated by extensive digging in the marshy area; Roland Windmiller dug out one section for peat, while another section was dug for fill for the construction of a nearby gasoline station. Both depressions were about nine feet deep and they quickly filled with water that subsequently was unable to drain off. Moreover, the excavation for landfill is suspected of damaging the old tile drainage pipe laid down at the turn of the century. At the present time, however, the lake does not appear to be growing any larger.

THE HYDROLOGY OF THE RESEARCH AREA

This lake formed by various hydrologic processes, the most significant being the height of the water table, which is the upper limit of the zone of saturation of water. When the level of the water table rises above the elevation of the land surface, a lake forms.

The level of the water table in this area is fairly close to the land surface. On nearby properties, wells were drilled which reached water at a level as shallow as eight feet, but the average depth to water is about twenty feet.

The lake and adjacent area is underlain by sand and gravel which originiated as glacial outwash. The materials are very porous, meaning there is a large percentage of empty space within the rock. The outwash is also very permeable, that is, fluids move through the rock easily. Since the zone is so permeable, wells drilled into this material yield as much as 1500 gallons per minute. There is a 500 g.p.m. well on the Windmiller farm.

Another factor which contributed to the formation of the lake is its proximity to the Scioto River, which is a zone of discharge. Groundwater flows toward and is discharged into the Scioto River. Groundwater tends to be close to the land surface near discharge areas, and well records substantiate that fact in the research area.

High permeability and proximity to a major discharge area have contributed to the rise of the water table, and thus to the formation of the lake on the Windmiller and adjacent properties. However these factors have also combined to create what is considered to be the most productive aquifer in Franklin County.

QUALITY OF THE WATER IN THE LAKE

Included in this report are the results of various tests run on one sample of water taken from the lake. Tests were conducted to determine the pH of the lake water, its alkalinity and hardness, and the concentrations of calcium, magnesium, chloride, nitrate, and iron.

The water has a moderate alkalinity and is quite hard. The pH of the water is 7.57, well within the permissable standard for public water supplies as declared by the Committee on Water Quality Criteria. The values for the concentrations of calcium and magnesium indicate the water iswithin permissable levels. The concentration of chloride and nitrate are lower than the permissable limits for public water supplies, but the concentration of iron is slightly higher than the permissable level.

The results of the tests run on the lake water indicate that the lake is not heavily polluted. Moreover, its ability to support a diverse biological community indicates that the water is not harmful to wildlife.

FIELD WORK CONNECTED WITH THIS REPORT

The research area of this report was visited on six occasions in 1982 and 1983. From each of these visits, new light was shed on the nature of the problem, and solutions became more apparent.

The first visit to the area was on September 1, 1982, at which time I was accompanied by Dr. Russell O. Utgard of the Ohio State University Department of Geology and Mineralogy. We thoroughly checked the area over from a geomorphological perspective, examining

Fig. 5. Ruins of old check point on the Ohio Canal.

Fig. 6. Dry channel of the Ohio Canal, abandoned around 1890. Scioto River is out of picture to the left, looking upstream.

erosion, drainage, and shore characteristics. We walked around the lake and made observations along the way pertaining to surface features and noting water levels, plant and animal life, etc.

The next visit to the area was on November 11, 1982. I went to the lake with Jeff De Freest, an Ohio State student with an interest in limnology. We took a few depth measurements and made some biological observations. Also, we took water samples and ran tests on the chemical composition of the lake water. However that day there was a steady drizzle which may have affected the accuracy of the test results.

On April 16, 1983 I made my third visit to the lake, accompanied by Tom Eaton, an O.S.U. undergraduate geology major, and by Fred Windmiller, who lives on the property. Mr. Windmiller was very helpful in pointing out aspects of the lake which might otherwise have gone unnoticed.

Previous to this third visit, Dr. Utgard and I had carefully examined the Columbus South 7½" Quadrangle topographic map to try to discern the drainage patterns in the area. Drainage studies made during this visit, however, confirmed our earlier conclusions that the lake drained to the south-southeast. Also during this visit we took careful bearing and distance measurements from which we were able to make a pace and compass map of the lake. During a three-hour traverse back and forth across the lake we took depth measurements from which I was able to make a map of the lake, which is included in this report. Along the way we took careful notes of birds and wildlife, but lakeside geomorphological aspects were somewhat obscured due to the high water level in the lake. Afterwards

we went to the neighboring Vick property to study their drainage efforts, which include a catch basin and a new field pipe that drains the property into Whittler Ditch.

On May 7, 1983 I visited the Windmiller farm to measure the distance from the Windmiller farmhouse to the lake, and the distance from the lake to the Scioto River. Later, Fred Windmiller and I used a tractor to excavate a drainage channel from the south side of the lake to the catch basin on the Vick property.

A fifth return visit was made on June 7, 1983, during which time I took a representative sample of the lake water. This was given to the Columbus Water and Chemical Testing Laboratory on Indianola Avenue; their chemical analysis of the water is included in this report.

RECOMMENDATIONS

There are several solutions to the "lake problem". Each should be considered before reaching a final decision.

The most obvious solution would be to completely drain the lake by placing an eight inch plastic field pipe in a trench about seven feet deep. This pipe could then be connected with the catch basin on the Vick property and eventually the lake would drain and diminish in area. The remaining depressions could then be filled in. The benefits of draining the lake are obvious: the land which is presently under water could be farmed, and a neighborhood breeding ground for insects would be eliminated. The excavation and pipe-laying should be professionally done. Estimates should be obtained before any work is done, and the quality of work should not be

compromised in order to reduce the cost.

Another solution would be to partially drain the lake, so that the lake is exclusively on the Windmiller property. The small lake could then by stocked with fish and could serve the recreational anglers in the area.

The lake is teeming with wildlife and could be developed into a park site or small wildlife refuge. However, for aesthetic reasons it should be cleaned up, and the dead tree stumps should be removed. If the park were carefully designed, planned, landscaped, and maintained, the residents in the area could benefit greatly.

ACKNOWLEDGEMENTS

I would like to thank the following people whose time, know-how, patience and resources helped bring this project to completion: Miss Helen Windmiller, who brought the problem to the attention of Dr. Russell O. Utgard at the Ohio State University Department of Geology and Mineralogy and whose insight into the problem was invaluable; her nephew Fred Windmiller, who was able to point out different aspects of the area and was willing to assist in any way he could; Tom Eaton, who helped with the pace-and-compass survey and depth measurements; Jeff De Freest, whose biologic and hydrologic knowledge was helpful; Dr. Ernest Ehlers of Ohio State for the use of his canoe; and Dr. Paul Colinvaux of the O.S.U. Botany Department for the use of his rubber raft.

I would also like to thank Dr. Russell O. Utgard of the Ohio State Geology Department, whose patience, time, and expertise

enabled me to determine the best way to research this problem and to come to constructive conclusions.

Finally, I would like to thank my wife, Nancy, and son James for their patience while this project was being researched and completed.

To all these people, I extend thanks.

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